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Differential Caregiving Behaviors Elicited by Infant Attractiveness:

The Role of Adult Affect

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Differential Caregiving Behaviors Elicited by Infant Attractiveness: The Role of Adult Affect

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Abstract

Differential Caregiving Behaviors Elicited by Infant Attractiveness:

The Role of Adult Affect

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Abstract: We examined the relationship between infant attractiveness and adult affect, focusing on the potential link between affect and differential treatment of attractive and unattractive infants in a two-phase study. In Phase 1, we investigated whether differing levels of infant facial attractiveness would elicit positive and negative affect from adults (N=87) using electromyography. Unattractive infant faces evoked significantly more *corrugator supercilii* and *levator labii superioris* movement (physiological correlates of negative affect) than attractive infant faces. In Phase 2, we measured caregiving behavior and explicit bias of the same adults toward two infant simulators, one attractive and one unattractive. Participants' positive affect, as measured by the Positive and Negative Affect Schedule, and explicit biases predicted how well they cared for the infant simulators, but their affect measured by the facial muscle movements in the EMG portion of the study did not. These results suggest that unattractive infants may be at risk for

negative affective responses from adults, though the relationship between those responses and caregiving behavior remains elusive.

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Chapter 1: Introduction and Literature Review

Facial attractiveness can influence developmental outcomes ranging from self-esteem (Hansell, Sparacino, & Ronchi, 1982) to salary (Hamermesh, 2011; Hamermesh & Biddle, 1994). It can elicit preferential treatment beginning in infancy (Langlois, et al., 2000), both from parents (Langlois, Ritter, Casey, & Sawin, 1995) and strangers (Stephan & Langlois, 1984). Stereotypes about children's and infants' abilities based on their physical attractiveness can influence social interaction and personality development (Langlois & Downs, 1979; Langlois & Stephan, 1981). This research seeks to examine attractiveness as a characteristic that elicits preferential treatment, namely through the relationship between adult affect and behavior toward children. A two-phase study focused on the relationship between adults' emotional responses to attractive and unattractive infants and their behaviors towards infant simulators of differential attractiveness. We used electromyography to detect subtle affective changes that may lead to differential treatment. To examine how different types of affect measurement might be associated with differential caregiving, we measured both facial muscle movement, a physiological correlate of affect, as well as self-reported affect.

Adult Judgments of Children Based on Attractiveness

Adults' ability to judge infants on attractiveness is highly reliable and consistent (Corter et al., 1978; Langlois et al., 2000), indicating that they are aware of the differences in attractiveness. For children judged as "cute," this may be beneficial: adult women presented with photographs of infants looked longer at infants rated high on cuteness (Hildebrandt & Fitzgerald, 1978). Meanwhile, children lower in attractiveness may face greater challenges, as research has shown that adults have negative biases and stereotypes about their abilities and personal characteristics (Stephan & Langlois, 1984; Ritter, Casey, & Langlois, 1991; Dion, 1972, 1974).

Stephan and Langlois (1984) presented undergraduates with a set of photographs of a triethnic sample of infants (3 and 9 months of age) and asked them to rate the infants for attractiveness and for 10 evaluative adjective pairs. They found that more attractive babies were rated as smart and likeable, whereas less attractive babies were rated as causing parents more problems. In a related study, mothers were shown photographs of 6 month-old infants with whom these mothers had no acquaintance. The mothers overestimated the age and developmental abilities of unattractive infants but not of attractive infants. Furthermore, the mothers judged unattractive infants to be capable of more specific developmental skills (e.g. motor abilities, cognitive abilities), but rated their general competence to be lower than that of attractive infants (Ritter et al., 1991). This indicates that infant attractiveness affects strangers' assumptions about them on a range of topics, and that the assumptions that these strangers make are not necessarily logical or cohesive. Generally, unattractive infants are associated with negative characteristics and considered to be less competent, but strangers may also expect them to have abilities that are not developmentally reasonable for their age group.

These types of judgments may be related to adults' aversion to looking at unattractive children's faces as well as their preference for looking at attractive children's faces. When presented with photographs of normal and abnormal baby faces (including babies with Down's syndrome, cleft palate, fetal alcohol syndrome, and skin disorders) and given the opportunity to increase or decrease the amount of time they looked at each individual face, men chose to increase their viewing time of normal baby faces, indicating a preference for looking at the faces of infants without abnormalities. Likewise, women decreased their viewing time for abnormal baby faces (Yamamoto, Ariely, Chi, Langleben, & Elman, 2009). This further suggests that adults may have preferences for normal and attractive infant faces over abnormal or unattractive ones.

Parental Treatment of Children Based on Their Attractiveness

The relation between adults' perceptions of children's attractiveness and their resulting behaviors is not limited to strangers who simply see photographs of these children. Parents also show differential behaviors toward their own children who are less attractive or who possess any number of facial irregularities. For example, Field and Vega-Lahr (1984) found that mothers of 3 month-olds with facial deformities smiled at, vocalized to, and imitated their infants less frequently and were less responsive to them than mothers of infants without facial deformities. Likewise, Allen, Wasserman, and Seidman (1990) found that mothers whose 3 year-olds had facial abnormalities exhibited more controlling behaviors and shared less verbalization with their children than mothers of control children.

In a sample of infants considered to be of "normal-range attractiveness," mothers displayed more affectionate behavior and sustained better eye contact with the more attractive infants (Parke & Sawin, 1975, as cited in Langlois, et al., 1995). Relatedly, Parke et al. (1977) found that fathers' involvement in their 3 month-olds' lives was significantly correlated with the baby's attractiveness as a newborn.

Langlois and colleagues (1995) investigated the parenting behaviors of low-income mothers toward their children soon after birth, as well as when the children were 3 months old. They found that mothers of more attractive newborns displayed more behaviors associated with affectionate interaction, whereas mothers of less attractive infants engaged in more routine caregiving and were more likely to attend to other people in the room. Less attractive infants were also perceived by their mothers as interfering more in their lives than were attractive infants. At 3 months of age, attractive infants were more likely to seek contact (e.g. touch, cling, and hold their mothers) than unattractive infants, possibly indicating that the caregiving they have received has already put them at an advantage in terms of social behavior and interaction (especially affiliative, attachment-related behaviors).

This pattern of results continues as children age and seems to intensify as other life stressors are added. Elder and colleagues (1985) found that when adolescent daughters were unattractive, economic hardship was predictive of nonsupportive, demanding, exploitive, and rejecting behavior from fathers. Daughters of rejecting fathers were more likely to have low opinions of themselves and less likely to set high goals for themselves, presenting an indirect link between attractiveness and personality/behavioral outcomes (Elder et al., 1985).

A large meta-analysis found that attractiveness consistently elicits differential expectations and behaviors from others, even when the interactants are familiar (Langlois et al., 2000). The authors called for more studies with young children in order to predict the order of emergence and the relationship between judgment, treatment, and child behavior and for more research on the preferential treatment given to children based on their attractiveness.

The Relation Between Affect and Parenting Behaviors

The interaction of affect and parenting behavior is a topic that has been studied most extensively in clinical populations (i.e., depressed mothers). A meta-analysis of maternal depression and parenting behaviors found that negative maternal behavior and disengagement from the child are associated with maternal depression. These effects are especially strong for mothers with infants (Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Observational studies add that depressed mothers often show less affectionate involvement and responsivity to the child, less engagement with the child, and lower synchrony with their infants (Field et al., 1990; Goodman & Brumley, 1990; Turney, 2011), as well as increased hostility and higher rates of negative interaction (Cohn, Campbell, Matias, & Hopkins, 1990; Goodman & Brumley, 1990; Lovejoy, 1991). Depressed mothers also show higher rates of neglect and psychological aggression toward their young children (Turney, 2011).

A recent meta-analysis (Rueger, Katz, Risser, & Lovejoy, 2011) of studies with non-clinical samples showed a significant relation between positive affect and supportive-positive parenting, as well as a significant relation between negative affect and both harsh-negative and intrusive parenting behaviors. Parental positive affect is correlated with stronger expressions of parental warmth and higher levels of social engagement with children (Rueger et al., 2011), as well as more supportive interactions (O'Hare, Weis, & Lovejoy, 1997). Higher levels of parental positive affect are also predictive of fewer child behavior problems (Boyum & Parke, 1995; Rubin et al., 2003; Baker et al., 2000).

Dix (1991) posits that low positive affect may decrease parents' ability to convey warmth and affection, as well as their willingness to engage in stimulating activities with their children. Similarly, high negative affect may lead parents to engage in more harsh discipline and hinder their abilities to appropriately respond to their child's needs. Although the relation between parental affect and parenting behavior is relatively well studied in clinical and non-clinical samples, there is currently no research that addresses how parental affect could mediate parents' differential behavior toward attractive and unattractive infants. Thus, if, in fact, child unattractiveness elicits low-level negative affect in the parent, this could partly explain the tendency of parents to display less sensitive, affectionate behavior toward unattractive children.

Measuring Affect

Electromyography. Electromyography (EMG) is often used to study affect and is a particularly useful technique because it can detect subtle changes in affective response. Certain muscles are correlated with specific affective responses and indications of liking, including participant self-reports of emotion (Larsen, Norris, & Cacioppo, 2003). For instance, imagining pleasant/unpleasant thoughts induces greater activity in certain facial muscles (Schwartz, Ahern, & Brown, 1979; Schwartz, Brown, & Ahern, 1980). Recording EMGs is non-invasive and painless (de Wied, van Boxtel, Zaalberg, Goudena, & Matthys, 2006; Garrity & Donoghue, 1977). Cacioppo and colleagues (1986) found that facial EMG yields reliable information about both the valence and the intensity of emotional reactions to stimuli. Facial EMG activity can occur even without awareness of the specific facial expression (Dimberg, Thunberg, & Elmehed, 2000), and additionally can detect mild affective reactions to subtle stimuli that do not elicit fully developed emotional expressions (Cacioppo, Bush, & Tassinary, 1992; Tassinary & Cacioppo, 1992; Dimberg et al., 2000).

Due to these methodological advantages, facial EMG has been used in several studies to capture differential affective reactions toward a variety of stereotyped groups. For example, Vanman, Saltz, Nathan, and Warren (2004) used EMG to show differences in muscle activation when looking at African-American/Caucasian faces. Participants showed differential affective responses toward faces of different races. These differences had not emerged for the same participants using the Implicit Association Test but were, in fact, more predictive of discriminatory behavior toward African-Americans.

Facial EMG has also been used in several studies to assess affect with regard to differential facial attractiveness. Researchers have found that neural activities related to attractiveness perception are engaged even when participants are not explicitly asked to judge it (Aharon et al., 2001; Johnston & Oliver-Rodriguez, 1997; Winston, O'Doherty, Kilner, Perrett, & Dolan, 2007; Trujillo, Jankowitsch, & Langlois, 2013), which furthers the argument that EMG can be used to reliably extract differential reactions from participants. Specifically, attractiveness effects have been found in the activation of *zygomaticus major* (ZM; pulling the corner of the lips into a smile) and unattractiveness effects in the activation of *corrugator supercili* (CS; knitting the brow) (Gerger, Leder, Tinio, & Schacht, 2011; Principe & Langlois, 2011).

Principe and Langlois (2011) found that unattractive adult male and female faces elicited significantly more *levator labii superioris* (LLS; raising the nostril/disgust) responses, whereas attractive faces were negatively correlated with knitted eyebrow movement (CS). Thus, attractive faces may induce more positive affect and/or less negative affect in adults. On the other hand, the intensity of muscle movement in this study indicates that unattractive faces may be more emotionally salient. However, it remains unclear whether these patterns would remain the same when babies are the target faces.

Self reported affect. EMG records affective responses to specific stimuli, including some responses that participants themselves fail to notice (Tassinary & Cacioppo, 1992). However, EMG does not measure global levels of affect or situational affect. Furthermore, EMG studies are relatively limited, due to the constraints of the technology—participants are attached to several wires, and are thus unable to move around or engage in a number of naturalistic behaviors.

Measuring emotion is a controversial topic: researchers use a variety of both psychophysiological and self-report measures to assess affective states and responses. The Positive And Negative Affect Schedule (PANAS) is used widely in emotion research (Crawford & Henry, 2004) to capture self-reported measures of the intensity of a list of positive and negative emotions, and captures levels of general affect. The PANAS was designed to capture reports of positive and negative affect independently (Watson Clark, & Tellegen, 1988). The developers of the PANAS report that for affect reported in the moment, the scale is highly internally consistent (α= .89 for positive affect, α=.85 for negative affect).

Implicit measures (such as the IAT and IRAP) and measures that record more subtle emotional responses (such as EMG) are more useful in cases where participants might show social desirability bias or feel uncomfortable admitting their biases. Generally, these methods indicate higher levels of bias than explicit questionnaires (see Roddy, Stewart, and Barnes-Holmes, 2011; Vanman, Paul, Ito, & Miller, 1997) and decrease sources of bias present in self-reports. The optimal solution may be to use EMG for subtle emotional responses to specific stimuli, and use the PANAS or other self-reported measure for global short- or long-term affect.

The present research utilizes multiple measures: both self-report and psychophysiological measures are employed in a two-phase study in order to account for the benefits and limitations of using each.

The Present Research

The present research examines attractiveness as a characteristic of infants that elicits preferential treatment through the relation between affect and caregiving behavior. The study was conducted in two phases. In a first phase (*Phase 1*), we assessed individuals' EMG responses to photographs of infants of varying attractiveness. In a second phase (*Phase 2*), we used self-reports of affect to predict caregivers' differential behavior toward attractive vs. unattractive infant simulators (ISs). We hypothesized: 1) Participants will show increased levels of negative affect, as measured by facial EMG (CS and LLS sites), while looking at images of unattractive infants; 2) Participants will show increased levels of positive affect (ZM site) while looking at images of attractive infants; 3) ZM amplitude (indicating positive affect) toward high attractive infants will predict positive caregiving behavior toward the attractive infant simulator; 4) CS and LLS amplitude (indicating negative affect) toward low attractive infants will predict a lack of caregiving behavior toward the unattractive infant simulator. 5) Participants' positive and negative affect while in the nursery simulation will predict amount of care given to the infant simulators; 6) Participants who indicate explicitly positive attitudes toward unattractive infants will display less differential parenting behavior, regardless of their affective responses, whereas participants who explicitly state that they prefer to spend time with attractive babies will spend more time with the attractive infant simulator than subjects who do not make that explicit statement.

Chapter 2: Phase One Methodology

In Phase One, we measured participants' facial muscle movements in response to photographic images of attractive and unattractive infants. Since it is difficult to accurately gauge participants' affective responses to negatively stereotyped groups, documenting negative affective reactions to unattractive infant faces would be a compelling demonstration of adults' biases.

Participants

Ninety-eight undergraduates (*M*= 20.26 years old, *SD*= 2.91 years; 49 female) were recruited through their Introductory Psychology course and received course credit in exchange for their participation. Subjects participated individually in one 2 hour-long session divided into two experimental phases. We excluded data from analysis for 11 participants for the following reasons: equipment (infant simulator) error (*n*=5), equipment (EMG) error (*n*=3), participant off-task (*n*=2), and real-life parent (*n*=1). The final sample included 87 participants (44 female) and included 35% Caucasian, 28% Asian/Asian-American, 27% Hispanic/Latino, and 10% African-American undergraduates.

Procedure

The experimenter instructed participants that we would be measuring their psychophysiological responses to images of infants. They were invited into the study room and sat in front of a computer. Research assistants were trained on interaction with the participants so that the participants would feel at ease. The experimenter attached to the participant's face seven Ag-AgCl electrodes filled with conductive gel. The electrodes were placed over the *corrugator supercilii* (brow muscle), the *zygomaticus major* (cheek muscle), and the *levator labii superioris* (nostril muscle) as well as the *orbicularis oculi* (under the eye, to control for eye-blink artifact) and at the top of the forehead as a control site (see Figure 1) using guidelines developed by Fridlund and Cacioppo (1986) for electrode site placement.

After the electrodes were attached, participants viewed a series of images of faces presented one at a time on a computer monitor. All images were shown for 2,000ms, with 4,000-8,000ms variable ISI. The faces were presented so that all faces were shown in random order once, then all faces were shown in random order a second time to decrease within-participant variability.

Stimuli

The images were 14 faces of 3-month-old infants. These faces were taken from a larger research study, and their inclusion was based on photo quality, infant neutral expression, infant age, and previously acquired cuteness ratings (for the "attractive" infants, M=5.10; for the "less attractive" infants, M=2.28, a statistically significant difference, p=.01).

With the aim of statistically controlling for perceived infant emotional expression in our analyses, the stimuli faces were rated by 56 independent raters on a 7-point scale of emotional expression, with 1 being *very negative*, 4 being *neutral*, and 7 being *very positive* ($\propto = .964$).

Data Coding and Dependent Variables

Facial muscle movement. The dependent measure is facial muscle activity, as reflected by wave amplitude measured in microvolts (mV). We used a 500Hz passband to filter the data to remove artifact and amplifier noise (Principe & Langlois, 2011; Fridlund & Cacioppo, 1986). We averaged across each of the two electrodes attached to each site of interest. The sites of interest are the CS (negative affect), LLS (negative affect), and ZM (positive affect) (Fridlund & Cacioppo, 1986).

We averaged the amplitude of the waveform for the 2,000ms of stimuli observation for each electrode site and subtracted the baseline, which is the average amplitude for the 2,000ms immediately preceding stimuli onset for that site. This number indicates the average muscular reaction to each infant face for each presentation. It is a "change" score, so it truly represents the experimental response to the stimulus (in this case, the infant's face) by controlling for general differences in baseline affectivity across participants.

We took the mean muscle movement (separately for each of the three muscle groups) for each of the 14 stimuli faces, averaged across the two stimuli presentations, and used those as the dependent variables, with infant face attractiveness as the independent variable.

Liking ratings. Subjects rated how much they liked each baby immediately after viewing its face each time on a scale of 1 to 7, with 1 being *do not like at all*, 4 being *neither like nor dislike*, and 7 being *like very much*. This provided an explicit rating of preference for the infants.

Chapter 3: Phase One Results

Effects of Infant Attractiveness on Affect: Controlling for Individual Variation in Participant Facial Muscle Movement

To control for individual participants' variation in baseline size of facial muscle movements, as well as individual variation in responsive facial muscle movements (i.e. the possibility that some participants would react more strongly to the differences in stimuli attractiveness than others), we analyzed the data using Hierarchical Linear Modeling.

Corrugator Supercilii. Using HLM, we isolated the random effects structure using restricted maximum likelihood to predict CS movement from infant attractiveness. Our analysis showed that the best model included both random intercepts and random slopes, and significantly predicted CS movement from attractiveness, $b = -.018$, $t(1130) = -3.75$, $p < .001$. This means that despite individual variation in facial muscle movement in response to a face of average attractiveness, and individual variation in the magnitude of response to faces across the attractiveness spectrum, there was a main effect of infant attractiveness on CS movement, such that unattractive infant faces elicited significantly more CS movement than attractive infant faces.

Levator Labii Superioris. We found evidence of electrode cross-talk between the *levator labii superioris* and the *zygomaticus major* (see similar findings in Principe & Langlois, 2011; Vrana, 1993), meaning that because of the muscles' proximity to one another, interference from the neighbor muscle obscured the true relationship between attractiveness and the target muscle. To remedy this, we constructed models controlling for the movement of the neighbor muscle.

To control for electrode cross-talk and examine LLS independently of the influence of ZM, we regressed ZM on LLS, and used the residuals as the outcome in an HLM model predicting LLS from infant attractiveness. This model also necessitated random intercepts and slopes, and significantly predicted LLS movement, b= -.011, t(1130)= -2.41, p= .016.

Zygomaticus Major. For ZM, we utilized the same technique we had used for LLS, controlling for electrode-cross talk by using participants' residualized scores in the analysis, thus stripping away the influence of LLS movement from ZM movement. In this case, the random effects structure also dictated that we use both random intercepts and slopes. However, there was no statistical significance of the effect of attractiveness on ZM movement, b= .014, t(1130)= 1.52, p= .13.

Overall, our predictions that infant attractiveness would predict facial muscle movement were confirmed. Infant unattractiveness predicted LLS and CS movement, which are indicators of participant negative affect.

Effects of Infant Attractiveness on Adult Affect: Controlling for Perceived Emotional Expression

Although the stimuli were photographed and chosen with the aim of using emotionally neutral faces, we decided to statistically control for the perceived emotional expression of the infant faces, to ensure that participants were not simply mirroring the affect they perceived to be displayed by the stimuli. Previous similar studies have omitted this statistical control.

Perceived Emotional Expression. We found a significant difference between attractive infant faces and unattractive infant faces in terms of perceived emotional expression, $t(12)= 3.64$, $p= .003$ ($M_{attractive}= 4.28$, $M_{unattractive}= 2.97$). Perceived infant emotional expression and infant attractiveness were highly correlated, $r(12)= .775$, $p= .001$, such that infants who were more attractive were perceived to be more positively emotionally expressive, and infants who were less attractive were perceived to be displaying more negative emotion. This is consistent with previous findings in the literature (Hildebrandt, 1983; Stephan & Langlois, 1984; Langlois, et al., 2000).

Corrugator Supercilii. We performed a multivariate linear regression, with infant attractiveness and infant perceived emotional expression predicting CS response. Attractiveness was significant in predicting CS movement, $b= -.011$, $t(11)= -2.17$, $p= .05$. Perceived emotional expression was a marginally significant predictor of CS movement, $b= -.015$, $t(11)= -1.929$, $p= .08$. This model accounted for a significant portion of the variance in CS muscle movement, $R^2= .772$, $F(1,11)= 29.614$, $p< .001$.

Levator Labii Superioris. For LLS movement, we controlled for ZM movement and used infant attractiveness and infant perceived emotional expression as predictors. In this regression, attractiveness was a marginally significant predictor, $b=-.010$, $t(10)=-2.00$, $p=.07$. In this model, perceived emotional expression was not a significant predictor of LLS movement, $b=-.004$, $t(10)=-.480$, $p=.64$. Because perceived emotional expression was not a significant predictor of LLS movement, it was removed from the model. The final model controlled for ZM movement and used infant attractiveness to predict LLS movement. With this model, we found that infant (un)attractiveness was a significant predictor of LLS (disgust) reactions, $b = -.011$, $t(11) = -3.97$, $p = .002$. This model accounted for a significant portion of the variance in LLS muscle movement, $R^2 = .884$, $F(1,11) = 41.97$, $p < .001$.

Zygomaticus Major. When controlling for perceived emotional expression in a linear model that predicts ZM movement from attractiveness, both attractiveness and perceived emotional expression are insignificant predictors. Using stepwise regression, we eliminated the less significant variable, emotional expression from the model. The final model found that infant attractiveness significantly predicted ZM (positive affect) responses after controlling for LLS cross-talk, $b = .020$, $t(11) = 3.75$, $p = .003$. Infant attractiveness accounts for a significant proportion of the variance in ZM responses, $R^2 = .876$, $F(1,11) = 38.96$, $p < .001$.

Relation Between Self-Reported Liking and EMG

Participants' ratings of how much they liked the infants significantly predicted their affective responses. When participants reported not liking the infant, they showed increased CS response, $b = -.026$, $t(12) = -4.56$, $p < .001$. After controlling for ZM movement, the same was true for LLS response: low ratings of liking predicted increased levels of negative affect, $b = -.018$, $t(11) = -4.10$, $p = .001$. After controlling for LLS movement, higher ratings of liking predicted higher levels of ZM movement, $b = .031$, $t(11) = 4.21$, $p = .001$.

Chapter 4: Phase One Discussion

Physiological Responses to Unattractive Infant Faces

As expected, we found a strong relationship between participants' negative affective reactions and unattractive infant faces. This was true both for the CS site and the LLS site, indicating that unattractive infant faces elicit more general negative affect as well as more disgust reactions than attractive infant faces. These results parallel Principe and Langlois' (2011) findings with adult face stimuli. This indicates a level of continuity in affective responses to unattractive faces; adult participants are sensitive to the attractiveness of both adult and infant faces, and accordingly display movement of certain facial muscles that are correlated with emotional reactions.

This is the first study to provide evidence that, in terms of eliciting affect, infants are not a "protected class" of face: adults can not only differentiate between more and less attractive infants, but they also experience physical negative reactions to unattractive infant faces. This finding contradicts the only previous study of the same phenomenon (Hildebrandt & Fitzgerald, 1978), which failed to establish that the attractiveness of infant faces could elicit differential types and levels of affective responses from adults. This could be due to our use of more electrode sites—Hildebrandt and Fitzgerald only recorded muscle movement on the ZM site. The inclusion of electrode sites that measured negative affect provides a more complete understanding of the ways in which adults are affectively processing infant faces.

The current findings contribute an extra element to the established attractiveness literature. Other studies (Stephan & Langlois, 1984; Ritter et al., 1991) have shown that adults make judgments about infants' personalities, behavior, and abilities based on their attractiveness, but the current study is the first to indicate that infant attractiveness may also influence adults' affective reactions. The facial movements demonstrated in this study indicate that in addition to judging the infants based on their attractiveness, adults are also processing and affectively reacting to those differences in infant attractiveness. Additionally, the finding that these affective responses are driven by negative affect toward unattractive infants, rather than positive affect toward attractive infants, is important one.

Another strength of this study is the use of different methods of analysis. Relatively few EMG studies have statistically controlled for individual variation in participant facial muscle movement. Other studies have used Friedman tests (Roddy et al., 2011), MANOVAs (de Wied et al., 2006), correlation (Vanman et al., 2004), and t-tests (Dimberg et al., 2000). Controlling for individual variation with HLM is a much stronger statistical test, which emphasizes the validity of our findings.

Additionally, other EMG studies using facial stimuli (e.g. Principe & Langlois, 2011; Hildebrandt & Fitzgerald, 1978) have failed to statistically control for the stimuli's perceived emotional expression. Given that participants perceived unattractive infants as being more emotionally negative, it is remarkable that participants' negative affective responses to the unattractive infants were still significant when perceived emotional expression was controlled for statistically.

Upon reflecting, it seems as though infant attractiveness influenced participants' perceptions of the infants' emotional expressions. Perhaps raters were generally evaluating "pleasantness" when they rated emotional expression. They may simply have been conflating attractiveness with affection, and attributing more positive attributes to the attractive infants (see Stephan & Langlois, 1984 for another example of this phenomenon).

Raters' merging of emotional expression and attractiveness parallels similar findings in the literature about perceptions of race. In studies comparing African-American and Caucasian faces, raters often interpret neutral or ambiguous African-American facial expressions as being more hostile or aggressive than their Caucasian counterparts (e.g. Sagar & Schofield, 1980; Hugenberg & Bodenhausen, 2003).

Contrary to Vanman and colleagues' (2004) results, we did not see a distinction between alternative ratings of bias and EMG responses. In their study, they found evidence that EMG responses did not correlate to scores on the Implicit Attitudes Test. In our study, liking ratings (which are an explicit judgment of the stimuli by the participants) significantly predicted affective responses to the infant photographs. Perhaps this distinction shows adults' willingness to honestly assess their responses to infant photographs.

These findings provoke a number of questions about whether these emotional reactions cascade into attitudes about the infant, and how these affective reactions could potentially cascade into behavioral outcomes, especially the differential treatment of attractive and unattractive infants. One EMG study focusing on race has already shown that implicit attitudes measured by EMG responses are predictive of stereotyping in real-world situations (Vanman et al., 2004), so it is reasonable to hypothesize that a similar process might ensue in adult-infant interactions, with the stereotyping based on attractiveness rather than race.

It is also unclear what the effect of repeated exposure to unattractive infant faces might be on the adults who encounter them. Might these negative affective reactions build up over time, especially for the primary caretaker for an unattractive infant? Future studies might investigate whether mothers of unattractive infants are more likely to show symptoms of depression.

Chapter 5: Phase Two Methodology

This phase examined the relation between self-reported participant affect and caregiving behavior toward two infant simulators of differing levels of attractiveness. Phase 1 established that participants have differential affective responses to attractive and unattractive infants, but did not explore the ways in which these affective responses might influence behavior in a more applied setting. The aim of this phase was to document how self-reported participant affect might interact with infant simulator attractiveness to influence caregiving behavior.

Phase 2 utilized the same participants as Phase 1, in a second experimental session that occurred immediately following participation in Phase 1.

Procedure

The experimenter explained to participants that we were interested in how parents care for young children in a busy environment. During this phase, participants spent 30 minutes caring for two Real Care infant simulators (TM Realityworks, Inc., 2013) in a lab setting designed to look like a nursery.

One of the benefits of the within-subjects design in which participants interact simultaneously with both ISs is that it creates a close analogy to visual preference tasks, while adding a more active behavior-focused parenting element. This method creates a forced choice for the participant so that s/he must either care for one simulator at a time, or otherwise pick up and hold one simulator (which we would consider to be a type of preference—privileging holding behavior over non-holding behavior, because it is more close, intimate, and affectionate) in order to care for them both concurrently.

In addition to caring for the infants, participants completed a set of puzzles to simulate a busy parenting atmosphere. They also completed a Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988) at the beginning, middle, and end of the half-hour to assess their affective state throughout the course of the experiment.

Finally, participants completed a set of post-experimental questionnaires, one about the infant simulators' traits, and one about participants' own explicit attitudes.

Materials

Infant Simulators. Real Care infants are computerized infant simulators (ISs) whose temperaments can be manipulated by programming the amount of care the simulators require. Both simulators are female, because some studies have found that physical attractiveness is more significantly correlated to the adjustment of females than males (Hansell, Sparacino, & Ronchi, 1982).

To manipulate facial attractiveness, a professional Hollywood special effects artist constructed realistic, silicone masks (mask methodology also utilized in Langlois, Roggman, & Rieser-Danner, 1990). The attractive infant mask was designed to look like a "Gerber baby," with chubby cheeks, wide eyes, and a marked Cupid's bow. The unattractive infant mask was modeled after a baby with Fetal Alcohol Syndrome, with small eyes and a thin face. Both infant masks have neutral facial expressions, so behavioral cues and participants' responses to the infant simulators should be based on attractiveness alone.

The ISs were rated for attractiveness by 41 independent participants to confirm that the attractive mask (M= 4.54) was significantly more attractive than the unattractive mask (M= 2.78), p< .001.

Both of the infant simulators were programmed to have the same schedule, therefore they required the exact same amount of care during the session (approximately 50% of the time) and they cried simultaneously.

See Table 2 for descriptive statistics for the independent and dependent variables in Phase 2.

PANAS. We averaged participants' scores over the 3 administrations of the scale for each emotion measured. We next performed exploratory factor analysis to see if the emotions could be grouped in any meaningful way. Based on that analysis, we combined the positive affective measures into a composite score, and did the same for the negative affective measures. See Table 3 for a list of the factor loadings and components of each composite score.

Post-Experimental Questionnaire. The first questionnaire asked about the infants' temperaments, preferences for one infant over another, and the participants' experience of how much time they spent with each baby. This questionnaire captures participants' perceptions of their own behavior, as well as explicit preferences they may have after interacting with the infant simulators (see Appendix A).

Explicit Attitudes Questionnaire. Participants rated their explicit feelings about how attractive and unattractive infants should be treated, the feelings that attractive and unattractive infants evoke, and the societal worth of attractive and unattractive infants

(See Appendix B). The explicit attitudes measure is internally consistent (α=.863). The explicit attitudes questionnaire was summed to create a composite score, where a higher score indicates more negative attitudes about unattractive infants. See Table 4 for inter-item correlations.

Data Coding and Dependent Variables

Behavioral Responses. We videorecorded participants from two angles in the nursery. These recordings were manipulated in AfterEffects so that the faces of the ISs were obscured, ensuring that coders would be blind to the attractiveness of the IS. Recordings were then coded for behavior toward the ISs.

Coders were trained to reliability with the lead researcher using training recordings before coding. Once coders were sufficiently reliable, they were each assigned to one of the two coded variables (Time Spent or Time Held), with an additional coder also assessing both variables for 25% of the participants. Overall reliability was high across coders (Time Spent ICC= .97; Time Held ICC= .98).

Time Held. We calculated the time that the participant held the infant simulator by supporting its head or keeping an arm around it. This includes walking around while holding the infant simulator closely or moving it from the crib to the changing table (or vice versa), but does not include when the infant simulator is resting in participant's lap (either lying or seated), because participants often leave the infant simulators lying in their laps without giving them head support or attending to them.

Time Spent. We calculated the time spent in any direct care given to the infant simulators. This may include feeding, changing, burping, or any other touching, including when the simulator is in the participant's lap. This distinction was based on Langlois and colleagues' (1995) finding that unattractive infants received care that was adequate, but less warm and physically close than that received by their attractive counterparts.

Chapter 6: Phase Two Results

Self-Reported Affect and Behavior in Nursery Simulation

Positive affect, as measured by the PANAS, predicted behavior toward the infant simulators. The positive affect composite score predicted the amount of time spent with the attractive infant simulator, $b= 7.401$, $t(85)= 3.410$, $p= .001$, $R^2= .120$; the amount of time spent with the unattractive infant simulator, $b= 6.306$, $t(85)= 2.919$, $p= .004$, $R^2= .091$; the amount of time spent holding the attractive infant simulator, $b= 10.084$, $t(85)= 4.245$, $p< .001$, $R^2= .175$; and the amount of time spent holding the unattractive simulator, $b= 6.306$, $t(85)= 3.361$, $p= .002$, $R^2= .117$ (see Figures 2 and 3). However, the negative affect composite score did not predict any measures of behavior toward the infant simulators ($p> .3$ for all analyses).

The negative affect composite score did not significantly predict differences in behavior toward the infant simulators (*p*s> .3), but the positive affect composite did trend toward significance in predicting the difference in holding time (the more warm, intimate behavioral measure) between the attractive and unattractive infant simulators, $t(85)= 1.854$, $p= .067$. Differences in levels of positive affect, rather than differences in levels of negative affect, predicted caregiving outcomes. This could be due to a higher mean and greater variability for the positive affect composite score ($M= 27.38$, $SD= 7.52$) as compared to the negative affect composite score ($M= 17.73$, $SD= 5.36$).

Explicit Attitudes and Behavior in Nursery Simulation

The composite explicit attitudes score predicted less time spent caring for both the attractive ($b= -6.904$, t(85)= -1.998, $p=.05$) and unattractive ($b= -8.633$, t(85)= -2.577, *p*=.01) infant simulators. This was also the case for the amount of time participants spent holding the infant simulators: when they had more explicitly negative attitudes about unattractive infants, they held the attractive (*b*= -8.669, t(85)= -2.220, *p*=.03) and unattractive (*b*= -9.487, t(85)= -3.088, *p*=.003) simulators less. All of these models have negative betas, suggesting that participants with higher/more biased explicit attitudes scores cared for and held both the attractive and unattractive infant simulator less than those who endorsed more positive attitudes.

This effect is driven by the behavior directed toward the unattractive infant simulator by participants whose scores were above the median (*M*= 24) for explicit bias. For those subjects with explicit bias scores less than or equal to the median, the bias score did not significantly predict caregiving behaviors toward either simulator. Explicit bias scores greater than the median predicted behavior toward the unattractive infant simulator, both for caregiving time (*b*= -19.948, t(85)= -2.914, *p*=.006) and holding time (*b*= -18.192, t(85)= -2.662, *p*=.01) (see Figures 4 and 5). Explicit bias scores greater than the median did not significantly predict behavior toward the attractive infant simulator (*p*s>.20). In the "high explicit bias" cases, the more participants' bias increased, the less time they spent caring for the unattractive infant simulator.

There was a small but statistically significant negative correlation between the explicit bias and positive affect, *r*= -.257, *p*= .021, indicating that participants with higher explicit bias scores were generally lower on positive affect.

Post-Experimental Questionnaire

In the post-experimental questionnaire, only 32% of participants perceived a physical variation between the two ISs. 71% of participants said that the temperaments of the ISs were different, but their ratings of which IS was more difficult were not significantly different from chance. When asked which IS they had spent more time with, and which they would choose to take care of, participants equally indicated the attractive and unattractive IS. Both ISs were rated 3.6 out of 7 points on a scale measuring cuteness.

These ratings differ from the independent assessment of the ISs' attractiveness, suggesting that there is something about the nature of the simulation that changes participants' perceptions of the ISs' attractiveness.

Chapter 7: Phase Two Discussion

Influence of Self-Reported Affect on Caregiving Behaviors Toward ISs

We found evidence that participants' self-reported emotional states influenced their caregiving behaviors. Specifically, we found that higher levels of self-reported positive affect predicted more caregiving and more nurturing behavior toward both ISs. In some ways, this finding validates our use of the IS methodology: it demonstrates that we can use this technology to elicit patterns of behavior that are similar to those found in studies with real parents, but with the advantage of being able to control for the attractiveness and temperament of the "infants" across different "parents."

The finding that positive affect correlates with caregiving behaviors parallels previous research about depressed mothers' interactions with their young infants. That body of literature has found that mothers who report depressive symptoms are likely to withdraw and show more passivity when interacting with their infants (Field et al., 1990). Their interactions are characterized by less warmth from the mothers, and tend to lack positive expressions of affect (Lovejoy et al., 2000). Depressed mothers also tend to touch their infants both less frequently and less affectionately than nondepressed mothers (Ferber, Feldman, & Makhoul, 2008). In our study, participants with low levels of positive affect showed less responsiveness and interaction with the ISs, as well as less warmth (as measured by holding behaviors, which are considered more close and intimate than other, more routine caregiving behaviors).

Our results also indicate that explicit attitudes toward unattractive infants play an important role in determining caregiving behaviors, especially for participants with high levels of explicit bias. This finding suggests that caregivers with high explicit biases are more likely to perceive and act on differences in infant attractiveness.

Chapter 8: General Discussion

Linking EMG Affect with Behavior Toward Infant Simulators

We used GLM regression to predict behavior toward each IS as a function of EMG response. EMG responses were measured in Phase 1 in response to images of real infants, whereas caregiving behavior was measured in Phase 2 using the infant simulators. Integrating data from Phases 1 and 2 involved 3 separate sets of regressions: 1) EMG amplitude in the *zygomaticus major* toward more attractive infant images predicting caregiving behavior toward the attractive infant simulator, 2) EMG amplitude in the *corrugator supercili* toward the less attractive infant images predicting caregiver behavior toward the less attractive infant simulator, and 3) EMG amplitude in the *levitor labii superioris* toward less attractive infant images predicting behavior toward the unattractive infant simulator. None of these analyses were statistically significant (see Table 5).

EMG responses to the photographs of attractive and unattractive infants also did not predict PANAS self-reported affect scores.

Self-Reported Affect vs. Facial Muscle Movement in Predicting Behavior

Both explicit attitudes and self-reported affect were significant predictors of caregiving behavior, whereas affect measured by EMG responses did not predict any caregiving behaviors. There are several possibilities that could explain this lack of finding: that the types of affect are conceptually separate, that some parameter of the study needs to be adjusted, or that there was a failure of the IS attractiveness manipulation.

It could be the case that EMG response doesn't predict caregiving behavior well because the affect reflected in EMG outcomes may be so subtle that it does not influence behavior. However, given the relatively strong evidence that participants are responding differentially to unattractive and attractive infant faces, and previous research that links differential EMG responses to discriminatory hiring behavior (Vanman et al., 2004), it seems as though the concepts of differential affective response and discriminatory caregiving behavior should be conceptually linked. However, we concede that our behavioral outcome measure may have been too complex. Rather than ask participants to choose between potential infants to care for (a typical outcome measure for this kind of study), we asked them to actually care for ISs. Caregiving behaviors are complicated, and differential caregiving is often quite subtle. It is certainly possible that our measures of caregiving behavior either were not sensitive enough, or were not sensitive to the right things. However, we believe that the ecological validity of our study outweighs the potential difficulty of using complex behavioral measures.

It is also possible that the methodology of the caregiving behavior portion of the study may need to be adjusted. It is plausible that using a between-subjects design might have yielded more interesting results. Studies with real mothers and their infants naturally utilize between-subjects designs using only one infant at a time, so perhaps our lack of parallel to that methodology shifted the parameters that allow caregivers to more naturally attend to an infant.

Relatedly, because our participants were not real parents, they may have felt a lack of investment in the caregiving task. Previous research has shown that biological parents are more likely to provide better care for their children than step-parents (e.g., Case & Paxson, 2001). Perhaps the ISs reduced caregiving behaviors in participants because these "parents" were not motivated to shift resources toward caregiving, given that neither IS carried their genetic material.

We know from previous research that people show more biased behaviors when they are under high cognitive load (e.g. Wigboldus, Sherman, Franzese, & van Knippenberg, 2004), so it is possible that our participants were not distracted enough by the demands of the low stakes puzzle tasks. Given the demands of caregiving, we assumed that our participants would have few cognitive resources and therefore be more likely to rely on stereotypical information and provide better caregiving toward attractive compared with unattractive infants. It is possible that our "cognitive load" manipulation did not, in fact, provide a high level of distraction from the caregiving task.

Another possibility is that the attractiveness manipulation (i.e., the facial masks) was constricted and not representative of the range of attractiveness in real infants. Participants reported that they did not perceive the ISs as looking different from each other. Additionally, because the ISs are relatively unattractive compared to real infants, they may both have been perceived as being unattractive.

To test this possibility, we had 40 additional independent participants rate the ISs for attractiveness within the context of the photographs from the EMG portion of the study, mixing images of the ISs in with the attractive and unattractive infant stimuli. In that context, the ISs were rated significantly lower than the unattractive real infants ($p < .001$), and were not rated significantly differently from one another ($p = .26$). Perhaps the order of the two studies (i.e. the presentation of real infant photographs before interaction with the ISs) biased participants' perceptions of the ISs' differential attractiveness. These context effects could certainly explain the lack of expected results.

Limitations

A limitation of the study is also a strength of the design: the infant simulators are not real babies. This is a limitation in that it constrains the possible interaction that a caregiver can have with the infant simulator. The ISs do not respond as real infants would—they do not smile or snuggle or move or do many of the more positive infant behaviors that exist in contingent interactions. However, while the ISs are limited in behavioral reciprocity, they allow us to experimentally control the temperament and behaviors of the infant so that each participant has the same experience. Assuring identical infant attractiveness and temperament across participants is certainly not something we could do with real infants.

Another limitation of our design concerns employing undergraduate students as the "caregivers." The students who participated in this study were not parents in real life, nor were they the parents of the ISs. They all had limited experience caring for infants, and belong to a restricted age range. However, infants interact with many adults (for example, hospital nurses and daycare providers), and it is possible that attractiveness biases will influence all of the care that an infant receives-- exploring the effects of attractiveness on caregiving in general (rather than focusing only on parenting) is still informative.

Future Directions

We have shown that adults display differential affective reactions toward attractive and unattractive infants, as measured by facial electromyography. We have also found evidence that participants' self-reported affect influences their caregiving behaviors toward infant simulators. Future work should explore the possibility of a relationship between parents' affective states/depression symptoms and their infants' attractiveness. Understanding the mechanism that leads to the differential treatment of attractive and unattractive infants will help us to structure future interventions that could lead to better, more sensitive parenting of all children, regardless of their facial attractiveness.

Table 1

Summary of Hypotheses and Results.

Hypothesis	**Outcome**
Increased levels of negative affect while looking at unattractive infant photos	True- attractiveness inversely predicts negative affect reactions
Increased levels of disgust while looking at unattractive infant photos	True- attractiveness inversely predicts disgust reactions
Increased levels of positive affect while looking at attractive infant photos	Unclear- depends on analysis type
More time spent caring for attractive infant simulator compared to unattractive infant simulator	False
Explicit attitudes about attractive/unattractive infants predict parenting behaviors toward ISs	True
Affect measured by EMG predicts behavior toward the ISs	False
Caregiver self-reported positive affect predicts behavior toward the ISs	True
Caregiver self-reported negative affect predicts behavior toward the ISs	False
Affect measured by EMG predicts affect measured by PANAS	False

Table 2

Variables in Phase 2.

Variable	Mean	SD	Range
Time Spent: Attractive	422.21	160.45	148.38 - 1067.34
Time Spent: Unattractive (in seconds)	410.15	157.11	172.12 - 1098.09
Time Held: Attractive	233.03	181.35	0 - 889.39
Time Held: Unattractive (in seconds)	226.01	146.33	0 – 769.84
PANAS: Positive Affect	26.21	9.17	14.33 - 48.67
PANAS: Negative Affect	16.88	6.25	10.33 - 32
Explicit Attitudes	25.32	5.12	16 - 37
Post-Experimental Questionnaire			

Table 3

Factor Loadings for Positive and Negative Affect on the PANAS, Resulting in the Use of Positive and Negative Composite Scores.

Emotion	Positive Affect Composite	Negative Affect Composite
Interested	**.765**	-.249
Distressed	.147	**.675**
Excited	**.768**	-.241
Upset	.203	**.753**
Strong	**.706**	-.287
Guilty	.229	**.702**
Scared	.355	**.725**
Hostile	.135	**.521**
Enthusiastic	**.786**	-.367
Proud	**.748**	-.266
Irritable	.015	**.653**
Alert	**.652**	-.085
Ashamed	.089	**.663**
Inspired	**.834**	-.171
Nervous	.335	**.640**
Determined	**.861**	-.169
Attentive	**.692**	-.043
Jittery	.417	**.484**
Active	**.750**	-.045
Afraid	.313	**.790**

Table 4

Item-Total Correlations for Explicit Attitudes Measure.

Item Number	1	2	3	4	5	6	7
1	1.000	.388	.653	.431	.272	.365	.394
2		1.000	.585	.686	.528	.526	.503
3			1.000	.574	.315	.384	.339
4				1.000	.636	.566	.554
5					1.000	.508	.661
6						1.000	.490
7							1.000

Table 5

Non-Significant Results Linking EMG to Caregiving Behavior.

DV	**IV**	***t***	***p***
Time Spent (Unattractive IS)	$CS_{unattractive}$	1.306	.195
	$LLS_{unattractive}$	.326	.746
Time Held (Unattractive IS)	$CS_{unattractive}$	.805	.423
	$LLS_{unattractive}$	.177	.860
Time Spent (Attractive IS)	$ZM_{attractive}$	.135	.893
Time Held (Attractive IS)	$ZM_{attractive}$	.010	.992

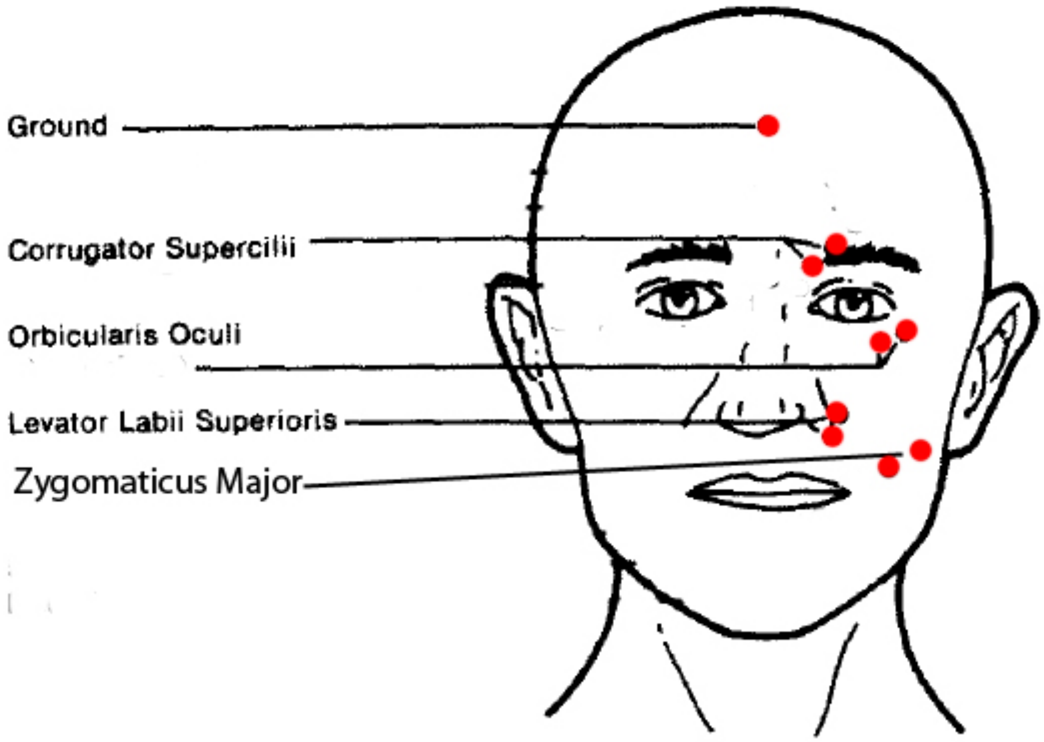

Figure 1. Explanation of electrode placement for facial electromyography.

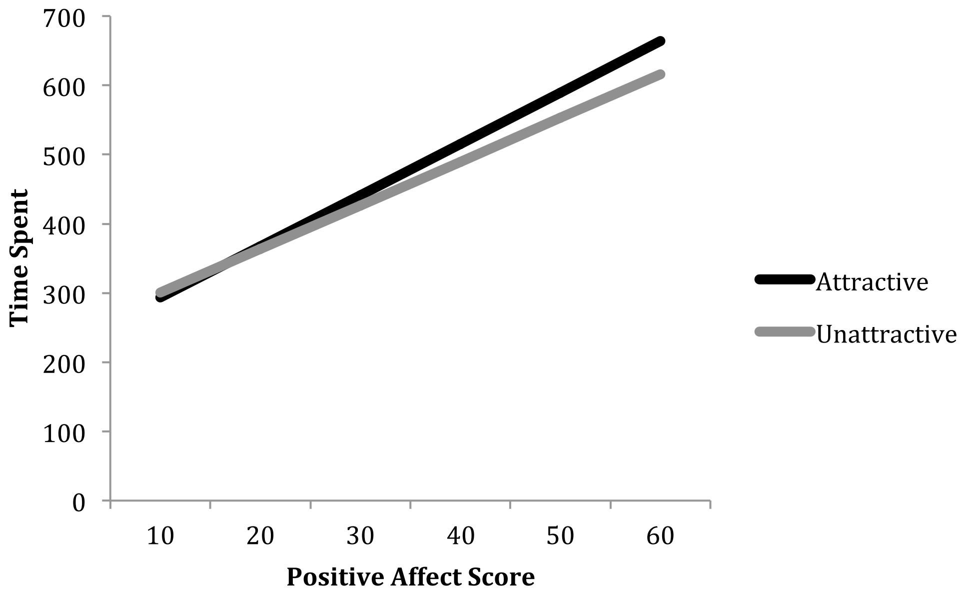

Figure 2. Time spent caregiving for each infant simulator as a function of participant positive affect.

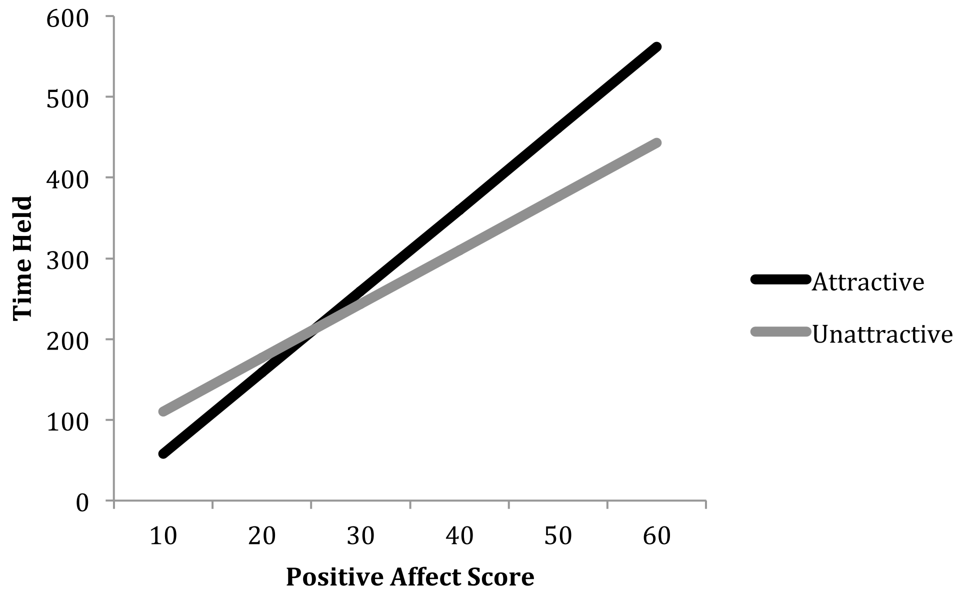

Figure 3. Time spent holding each infant simulator as a function of participant positive affect.

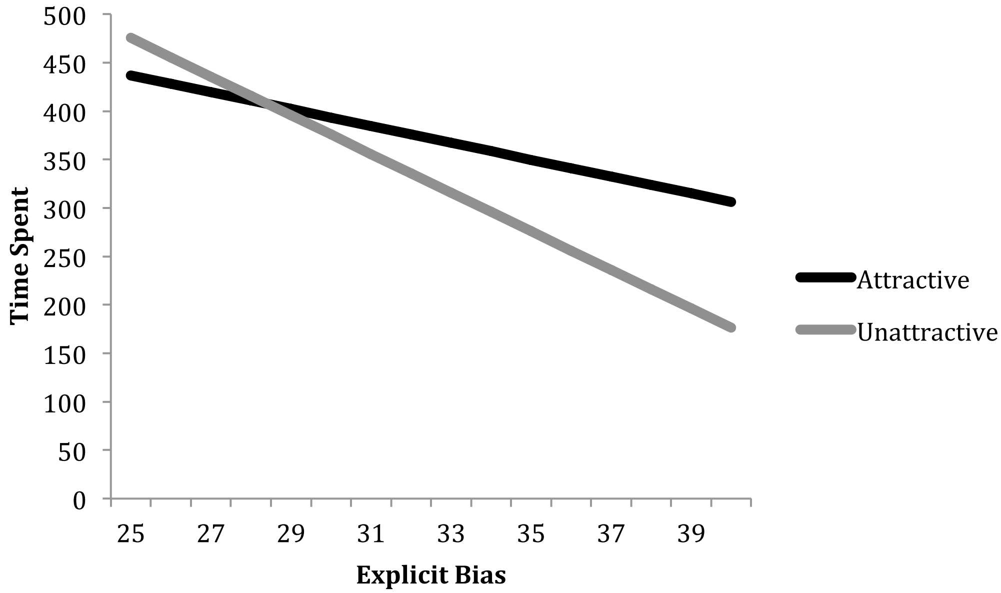

Figure 4. For those with high levels of explicit bias (above the median), time spent caregiving for each infant simulator as a function of explicit bias.

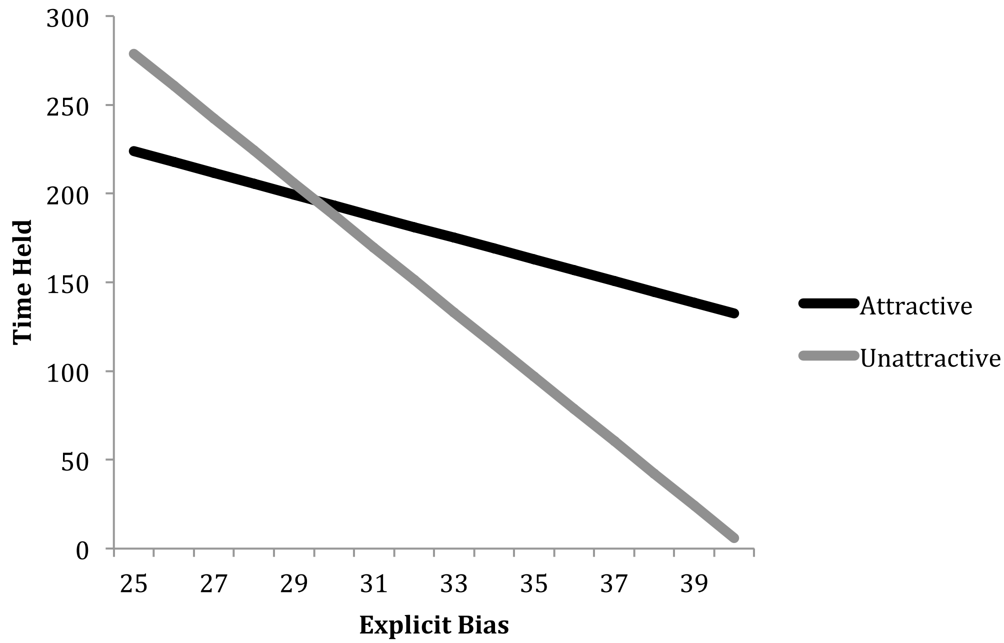

Figure 5. For those with high levels of explicit bias (above the median), time spent holding each infant simulator as a function of explicit bias.

Appendix A

Post-experimental questionnaire

1. Do you think you spent more time with one baby than another?

Circle: YES NO

If yes, who?

Circle: Amanda Allison

2. If you could choose either Amanda or Allison to take care of, who would you choose and why?

3. Please describe each of Amanda and Allison's temperaments.

4. Do you think Amanda and Allison varied in terms of temperament?

Circle: YES NO

a. If yes, who do you think had the more difficult temperament?

Circle: Amanda Allison

5. Do you think Amanda and Allison varied physically?

Circle: YES NO

a. If yes, how would you describe these differences?

Please rate on a scale from 1 to 7.

8. How difficult was Amanda's temperament?

1 2 3 4 5 6 7

most easy most difficult

9. How difficult was Allison's temperament?

1 2 3 4 5 6 7

most easy most difficult

10. How cute is Amanda?

1 2 3 4 5 6 7

least cute most cute

11. How cute is Allison?

1 2 3 4 5 6 7

least cute most cute

Appendix B

Explicit Attitudes Questionnaire

1. I believe that unattractive babies need special treatment because they are already at a disadvantage.

1	2	3	4	5	6	7
not true						very true

2. I have no interest in unattractive babies.

1	2	3	4	5	6	7
not true						very true

3. I think attractive babies deserve more attention because they have greater potential.

1	2	3	4	5	6	7
not true						very true

4. Unattractive babies make me feel uncomfortable.

1	2	3	4	5	6	7
not true						very true

5. I would prefer to spend time with an attractive baby rather than an unattractive one.

1	2	3	4	5	6	7
not true						very true

6. I feel sorry for unattractive babies.

1	2	3	4	5	6	7
not true						very true

7. Attractive babies are easier to love.

1	2	3	4	5	6	7
not true						very true

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